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The Hamburg/SAO Survey for Emission–Line Galaxies

IV. The Fourth List of 119 Galaxies

A.Y. Kniazev[1,8], D. Engels[2], S.A. Pustilnik[1,8], A.V. Ugryumov[1,8], T.F. Kniazeva[1], A.G. Pramsky[1], N. Brosch[3], H.-J. Hagen[2], U. Hopp[4], Y.I. Izotov[5], V.A. Lipovetsky[1,⋆], J. Masegosa[6], I. Márquez[6], and J.-M. Martin[7]

[1] Special Astrophysical Observatory, Nizhnij Arkhyz, Karachai-Circessia, 369167, Russia
[2] Hamburger Sternwarte, Gojenbergsweg 112, D-21029 Hamburg, Germany
[3] Wise Observatory, Tel-Aviv University, Tel-Aviv 69978, Israel
[4] Universitätssternwarte München, Scheiner Str. 1, D-81679 München, Germany
[5] Main Astronomical Observatory, Goloseevo, Kiev-127, 03680, Ukraine
[6] Instituto de Astrofisica de Andalucia, CSIC, Aptdo. 3004, 18080, Granada, Spain
[7] Département de Radioastronomie ARPEGES, Observatoire de Paris, F-92195 Meudon Cedex, France
[8] Isaac Newton Institute of Chile, SAO Branch

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Abstract. We present the fourth list with results[1] of the Hamburg/SAO Survey for Emission-Line Galaxies (HSS hereafter, SAO – Special Astrophysical Observatory, Russia). The list is a result of the follow-up spectroscopy conducted with the 6 m SAO RAS telescope in 1998, 1999 and 2000. The data of this snap-shot spectroscopy survey confirmed 127 emission-line objects out of 176 observed candidates and allowed their quantitative spectral classification. We could classify 76 emission-line objects as BCG/HII galaxies or probable BCGs, 8 – as QSOs, 2 – as Seyfert galaxies, 2 – as super-associations in a subluminous spiral and an irregular galaxy, and 37 as low-excitation objects – either starburst nuclei (SBN), or dwarf amorphous nuclei starburst galaxies (DANS). We could not classify 2 ELGs. Furthermore, for 5 galaxies we did not detect any significant emission lines. For 91 emission-line galaxies, the redshifts and/or line intensities are determined for the first time. Of the remaining 28 previously known ELGs we give either improved data on the line intensities or some independent measurements.

The candidates were taken from three different samples selected by different criteria. Among our first priority candidates we achieved a detection rate of emission-line objects (ELGs + QSOs) of 68%, among which 51% are BCGs. Observations of a random selected sample among our second priority candidates showed that only ≈10% are BCGs. We found that the confirmed BCGs have usually a blue colour ($(B-R) < 1\overset{\mathrm{m}}{.}0$) and a non-stellar appearance in the APM database. Our third sample is comprised of second priority candidates fulfilling these criteria derived from the APM. Follow-up spectroscopy of a small subsample indicates that the expected detection rate for BCGs is ≈40%.

Key words: surveys – galaxies: fundamental parameters – galaxies: distances and redshifts – galaxies: starburst – galaxies: compact – quasars: redshifts

1. Introduction

The main goal of the Hamburg/SAO Survey for Emission-Line Galaxies (HSS) is the search for emission-line galaxies (ELG) in order to create a new deep sample of blue compact/HII galaxies (BCG) in a large area of the sky with a size of the order 1700 square degrees. Another important goal of this work is to search for new extremely low-metallicity galaxies. The search is carried out on the objective prism plates of the Hamburg Quasar Survey (Hagen et al. 1995). The boundaries of our survey are 7^h20^m to 17^h40^m in right ascension and $+35°$ to $+50°$ in declination, which bridges the gap between the zones of the Second Byurakan Survey (SBS; Markarian et al. 1983, Stepanian 1994) and the region covered by the Case (Pesch et al. 1995) survey. The SBS is situated at $\alpha = 7^h40^m \div 17^h20^m$, $\delta = +49° \div +61°$, while the Case zone corresponds to the region with $\alpha = 8^h00^m \div 16^h20^m$, $\delta = +29° \div +38°$. After combination of the four BCG samples coming from the SBS (Izotov et al. 1993a, 1993b, Thuan et al. 1994, Pustilnik et al. 1995), from the Case survey (Salzer et al.

Send offprint requests to: akn@sao.ru
⋆ Deceased 1996 September 22.
[1] Tables 3 to 8 are only available in electronic form at the CDS via anonymous ftp to cdsarc.u-strasbg.fr (130.79.128.5) or via http://cdsweb.u-strasbg.fr/Abstract.html. Figures A1 to A12 will be made available only in the electronic version of the journal.

1995, Ugryumov 1997, Ugryumov et al. 1998), from the HSS, and from part of the Heidelberg Void survey sample (Popescu et al. 1996), a large Northern BCG Sample covering about 1 steradian will be available.

In the Papers I and II ((Ugryumov et al. 1999, Pustilnik et al. 1999) we presented results of our survey in the region between δ =40–50°, while in Paper III (Hopp et al. 2000) and the present paper results from the strip δ =35–40° are given. Forthcoming papers will complete the follow-up spectroscopy in these two regions.

The article is organized as follows. In Section 2 we will review our selection method and present the samples discussed here. In Section 3 we describe the spectroscopic observations and the data reduction. In Section 4 the results of the observations are presented in several tables. In Section 5 we briefly discuss the new data and summarize the current state of the Hamburg/SAO survey. Throughout this paper a Hubble constant H_0 = 75 km s^{-1} Mpc^{-1} is used.

2. Selection method

The basic ideas of the HSS and its selection methods of ELG candidates are described in Paper I. The final selection was slightly modified to improve significantly the detection rate of ELGs in the follow-up spectroscopy as described in Paper II. As it was outlined in Paper I, the selection procedure provided us finally with two candidate lists (first and second priorities): 1st – objects showing a clear density peak near λ 5000 Å and blue continuum in the Hamburg Quasar Survey objective-prism spectra scanned with high resolution; 2nd – candidates with a blue continuum but without prominent emission features or candidates with indications of emission peaks but with an unusual continuum shape. In short, the ELG candidate selection criteria applied are a blue or flat continuum (near λ 4000 Å) and the presence of strong or moderate [O III] $\lambda\lambda$ 4959,5007 Å emission lines recognized on digitized prism spectra. Candidates accepted had B-magnitudes in the range $16^m - 19.^m5$.

Based on the experience with a training sample of BCGs drawn from the Second Byurakan Survey (see Paper I for details) the first priority candidates were considered as highly probable H II/BCG type emission galaxies. The follow-up snap-shot spectroscopy confirmed that among all detected ELGs this type of galaxies constitutes up to 70–80%. Thus, our main goal to create a large new sample of BCG/H II-galaxies in the HSS region is achieved by follow-up spectroscopy of the full sample of first priority candidates.

In this paper we will present the results for follow-up spectroscopy of three samples listed in Table 1. The first sample is made up by 139 first priority candidates in the strip δ =35–40° of which 26 are known ELGs. For the latter galaxies additional spectra were required to improve their classification.

The other two samples were drawn from the second priority candidates of the same strip. We found in Paper I that the detection efficiency of H II/BCG galaxies is rather low among them, prohibiting follow-up spectroscopy of all second priority candidates. Moreover, the second priority objects are about twice as numerous than the first priority ones. At the faint end, this sample is also dominated by candidates selected because of noise peaks in their objective prism spectra. We created therefore a random selected sample of 43 second priority objects from this strip matching in its magnitude distribution the sample of first priority candidates. These objects make up 10% of the second priority sample in the magnitude range of the first priority candidates. We obtained follow-up spectroscopy of all objects to study the general content and to determine the fraction of BCGs in this sample.

The third sample (referred to as *APM Selected* in Table 1) was created by applying additional selection criteria to the second priority candidates to increase the detection efficiency for BCG/H II-galaxies among them. These criteria and the results of follow-up spectroscopy are described in Section 4.2.2.

3. Spectral observations and data reduction

3.1. Observations

All results presented below have been obtained by observations with the Russian 6 m telescope, mainly in the snap-shot mode during 4 runs between December 1998 and February 2000. The spectrograph SP-124 attached to the Nasmyth-1 focus of the telescope was used during the first run. We used a grating with 300 grooves/mm (see log of observations in Table 2) and a long slit of 2″×40″. The scale along the slit was 0.4″/pixel.

The Long-Slit Spectrograph (LSS in Table 2) (Afanasiev et al. 1995) attached to the telescope prime focus was used during the remaining 3 runs. Most of the long-slit spectra (1.″2–2.″0×180″) were obtained with a grating of 325 grooves/mm, giving a dispersion of 4.6 Å/pixel. Additional data were obtained with a grating of 650 grooves/mm giving a dispersion of 2.4 Å/pixel. The scale along the slit was 0.39″/pixel. For all observations we used the Photometrics CCD-detector PM1024 with $24 \times 24 \mu$m pixel size.

Normally, short exposures were used ($2-5$ minutes) in order to detect strong emission lines, to measure redshifts and make a first classification. Reference spectra of an Ar–Ne–He lamp were recorded before or after each observation to provide a wavelength calibration. Spectrophotometric standard stars from Oke (1990) and Bohlin (1996) were observed for flux calibration at least twice a night. All observations and data acquisition have been conducted

Table 1. Summary of the samples observed and breakdown of the classifications after follow-up spectroscopy

Candidate Classification	Sample	N	BCGs	Other ELGs	QSO	Galaxies without ELs	Stars	Not Classified
First priority	new	113	47	24	7	3	7	25
	already known	26	19	7	–	–	–	–
	Total	139	66	31	7	3	7	25
Second priority	6 m observations	26	1	10	1	1	9	4
	2.2 m observations	17	3	2	–	1	3	8
	Random (total)	43	4	12	1	2	12	12
	APM selected (total)	11	7	4	–	–	–	–
Objects presented in this paper		176	74	45	8	4	16	29

Table 2. Log of observations at the SAO 6 m telescope

Run No (1)	Date (2)			Instrument (3)	Grating [grooves/mm] (4)	Wavelength Range [Å] (5)	Dispersion [Å/pixel] (6)
1	17–19	Dec	1998	CCD, SP–124	300	3600–7800	4.6
2	08–13	Feb	1999	CCD, LSS	325	3600–7800	4.6
3	02	Sep	1999	CCD, LSS	650	3700–6100	2.4
	04	Sep	1999	CCD, LSS	325	3600–7800	4.6
4	02	Feb	2000	CCD, LSS	650	3700–6100	2.4

under the `NICE` software package by Kniazev & Shergin (1995) in the MIDAS[2] environment.

Part of the second priority candidates was observed with the 2.2m telescope on Calar Alto in June 1999. These observations will be presented in a forthcoming paper, although we will make use of the results in our analysis below.

3.2. Data reduction

The data reduction was done at SAO with the IRAF[3] and the MIDAS software packages. In all details of the reduction process and the measuring of line parameters we followed the procedures described in Paper III. Since we present a substantial number of objects with redshifts known from earlier publications, we could independently test the quality of our wavelength calibration. The results of these tests indicate that our internal errors σ_V shown in Table 3 are close to the external errors and do not change from run to run.

[2] MIDAS is an acronym for the European Southern Observatory package — Munich Image Data Analysis System.

[3] IRAF is distributed by National Optical Astronomical Observatories, which is operated by the Association of Universities for Research in Astronomy, Inc., under cooperative agreement with the National Science Foundation

4. Results of follow–up spectroscopy

4.1. First priority candidates

In total 139 first priority candidates have been observed (Table 1). Of them 26 objects were known as ELG before. In particular, seven of them are from our Paper III, for which the classification was either unknown or uncertain. Of these 139 objects 97 (75%) are new or confirmed emission-line galaxies.

4.1.1. Emission-line galaxies

The emission line galaxies observed are listed in Table 3 containing the following information:
column 1: The object's IAU-type name with the prefix HS.
column 2: Right ascension for equinox B1950.
column 3: Declination for equinox B1950. The coordinates were measured on direct plates of the HQS and are accurate to $\sim 2''$ (Hagen et al. 1995).
column 4: Heliocentric velocity and its r.m.s. uncertainty in km s^{-1}.
column 5: Apparent B-magnitude obtained by calibration of the digitized photoplates with photometric standard stars (Engels et al. 1994), having an r.m.s. accuracy of $\sim 0\overset{m}{.}5$ for objects fainter than $m_B = 16\overset{m}{.}0$ (Popescu et al. 1996). Since the algorithm to calibrate the objective prism spectra is optimized for point sources the brightnesses of extended galaxies are underestimated. The resulting sys-

tematic uncertainties are expected to be as large as 2 mag (Popescu et al. 1996). For about 1/3 of our objects, B-magnitudes are unavailable at the moment. We present for them blue magnitudes obtained from the APM database. They are marked by a "plus" before the value in the corresponding column. According to our estimate they are systematically brighter by $0\overset{m}{.}92$ than the B-magnitudes obtained by calibration of the digitized photoplates (r.m.s. $1\overset{m}{.}02$). For all objects marked as from Popescu et al. (2000) one may find improved B-magnitudes in Vennik, Hopp & Popescu (2000) which we do not list here for the sake of homogeneity.
column 6: Absolute B-magnitude, calculated from the apparent B-magnitude and the heliocentric velocity. No correction for galactic extinction is made as all objects are located at high galactic latitudes and because the corrections are significantly smaller than the uncertainties of the magnitudes.
column 7: Preliminary spectral classification type according to the spectral data presented in this article. BCG means that the galaxy possesses a characteristic HII-region spectrum and that the luminosity is low enough. SBN and DANS are galaxies of lower excitation with a corresponding position in line ratio diagrams, as discussed in Paper I. SBN are the brighter fraction of this type. We here follow the notation of Salzer et al. (1989). Seyfert galaxies are separated mainly on diagnostic diagrams as AGN. The criterion of broad lines was also used for the Sy classification. With SA two probable super-association in a spiral and an irregular galaxy are denoted. Two ELGs are difficult to classify. They are coded as NON.
column 8: One or more alternative names, according to the information from NED.[4] References to other sources of spectral information indicating that a galaxy is an ELG are given in bold face.

The spectra of all emission-line galaxies are shown in Appendix A, which is available only in the electronic version of the journal.

The results of line flux measurements are given in Table 4. It contains the following information:
column 1: The object's IAU-type name with the prefix HS. By asterisk we note the objects observed during non-photometric conditions.
column 2: Observed flux (in $10^{-16}\,\mathrm{erg\,s^{-1}\,cm^{-2}}$) of the H$\beta$ line. For few objects without Hβ emission line the fluxes are given for Hα and marked by a "plus". For several objects observed during non-photometric conditions this parameter is unreliable and marked by (:).
columns 3,4,5: The observed flux ratios [OII]/Hβ, [OIII]/Hβ and Hα/Hβ. For few objects without Hβ flux ratios are given for Hα and marked by a "plus".
columns 6,7: The observed flux ratios [NII] λ 6583 Å/Hα, and ([SII] λ 6716 Å + λ 6731 Å)/Hα.
columns 8,9,10: Equivalent widths of the lines [OII] λ 3727 Å, Hβ and [OIII] λ 5007 Å. For few objects without detected Hβ emission line the equivalent widths are given for Hα and marked by a "plus".

Among the 97 ELGs observed as first-priority candidates, 66 are classified as BCGs or probable BCGs. Two very faint objects (HS 1134+3640 and HS 1308+3845) are probably super-associations in the dwarf spiral NGC 3755 and in the Im galaxy UGC 8261. Two ELGs are probable LINERs. One candidate is difficult to classify. The remaining 26 ELGs are objects of lower excitation: either starburst nuclei galaxies (SBN and probable SBN) or their lower mass analogs dwarf amorphous nuclear starburst galaxies (DANS or probable DANS).
Below we give notes on several individual objects:
HS 0847+3639: The HS magnitude for this galaxy seems to be too faint. The KUG magnitude (Takase & Miyauchi-Isobe 1993) B=$15\overset{m}{.}4$ corresponds to M_B=$-19\overset{m}{.}6$ and an SBN classification as given in Table 3.
HS 0934+3629: The FWHMs, corrected for instrumental resolution, for Hα and Hβ are ≈1800 km s^{-1} and ≈1400 km s^{-1}, respectively.
HS 1047+3714: Very strong NII line λ6583 Å, Hβ is only seen in absorption.
HS 1116+3951: Uncertain Hα/Hβ ratio because of a cosmic hit on Hα.
HS 1134+3639: Probable low-mass companion of the galaxy NGC 3755 (the distance is ≈230″ or ∼25 kpc).
HS 1134+3640: Possible giant HII-region at the very edge of the SAB(rs)c pec galaxy NGC 3755 with V_{hel} =1570 km s^{-1}, seen at an inclination angle of ≈60°. The HI-line width at the level of 0.2 of the peak flux value $W_{0.2}$=290 km s^{-1} (Huchtmeier & Richter 1989) corresponds to a maximum V_{rot} of ≈150 km s^{-1}. In accordance with the difference in radial velocities (–108 km s^{-1}) of HS 1134+3640 and the dynamical center of NGC 3755, HS 1134+3640 is either an HII-region in NGC 3755, or a companion like HS 1134+3639. The real situation can be checked only if it is determined whether this edge of NGC 3755, corresponds to the receding or approaching spiral arm.
HS 1308+3545: Giant HII-region at the edge of the B=$16\overset{m}{.}0$ Im galaxy UGC 8261 with V_{hel} =852 km s^{-1}. Its HI-line width $W_{0.2}$=127 km s^{-1} corresponds to a maximum V_{rot} of ≈65 km s^{-1}. This is consistent with the measured difference in the radial velocities of HS 1308+3545 and the dynamical center of the Im galaxy.
HS 1620+4003: The profiles of the OIII-lines λ 4959,5007 Å have a composite structure with a narrow (FWHM_{5007} = $\mathrm{FWHM}_{H\beta}$) and broad (FWHM = ≈1800 km s^{-1}) component. The broad to narrow component flux ratio is 1.44.

4.1.2. Quasars

In the course of our follow-up spectroscopy, seven QSOs were discovered with a strong emission line in the wave-

[4] http://nedwww.ipac.caltech.edu/

length region between 5000 Å and the sensitivity break of the Kodak IIIa-J photoemulsion near 5400 Å. In all of them, we identified Ly$\alpha\,\lambda$1216 redshifted to z ∼ 3 as the responsible line. These mostly faint quasars are not found by the HQS itself, which focuses on objects with brightnesses B≤17$^{\rm m}$5 (Hagen et al. 1999). The data for these 7 new high-redshift quasars (and one from the second priority candidates) are presented in Table 5. Finding charts and plots of their spectra can be found on www-site of the Hamburg Quasar Survey (http://www.hs.uni-hamburg.de/hqs.html).

4.1.3. Absorption-line galaxies

For three bright non-ELG galaxies (and one from the second priority candidates) the signal-to-noise ratio of our spectra was sufficient to detect absorption lines, allowing the determination of redshifts. The data are presented in Table 6.

4.1.4. Stellar objects

To separate the stars among the objects missing detectable emission lines we cross-correlated a list of the most common stellar features with the observed spectra. In total, 7 objects with definite stellar spectra and redshifts close to zero were identified (and 9 from the second priority candidates). They were classified roughly in categories from definite A-stars to G-stars, with most of them intermediate between A and F. The data for these stars are presented in Table 7.

4.1.5. Not-classified objects

Twenty five non emission-line objects are hard to classify at all. Their continua have too low signal-to-noise ratio to detect trustworthy absorption features, or the EWs of the emission lines are too small.

4.2. Second priority candidates

4.2.1. The random selected sample

From the random selected subsample of second priority candidates we observed twenty six objects during the 6-m telescope runs (mainly those with R.A.< 11^h) along with the observations of first priority targets. Altogether we found 12 emission-line objects: one appeared to be a QSO with z =3.15, and the rest are various types of ELGs. They are shown in Table 3 and 4, respectively, and are marked by †. Nine objects are stars of spectral classes from A to G, with one M-star. One object is an absorption-line galaxy. The remaining four second priority candidates have no (trustworthy) emission lines, and are probably either absorption line galaxies, or various types of stars. They are considered as "not classified" in Table 1. Among the 11 ELGs only one has a spectrum and an absolute magnitude indicative of a BCG/HII-galaxy. The others are either low excitation ELGs like SBN and DANS, or AGN like LINERs or Sy galaxies.

The remaining 17 candidates were observed with the 2.2m telescope and three probable BCGs were found among them. Preliminary spectral classification type for these objects are shown in the last column of Table 8. Classification of ELGs follows that described for Table 3. "Star" is star-like object with absorptions at zero redshift. "ABS" is a galaxy with detected and identified absorption lines. "NOEM" is an object with no (trustworthy) emission lines detected.

In total, we found 4 (probable) BCG/HII-galaxies in the random selected sample making up a fraction of ≈10%.

4.2.2. The APM selected sample

To improve the efficiency for the selection of BCGs among the second priority candidates we introduced additional selection criteria using the APM (Irwin 1998) database. An analysis of the spectroscopic classifications of all ob-

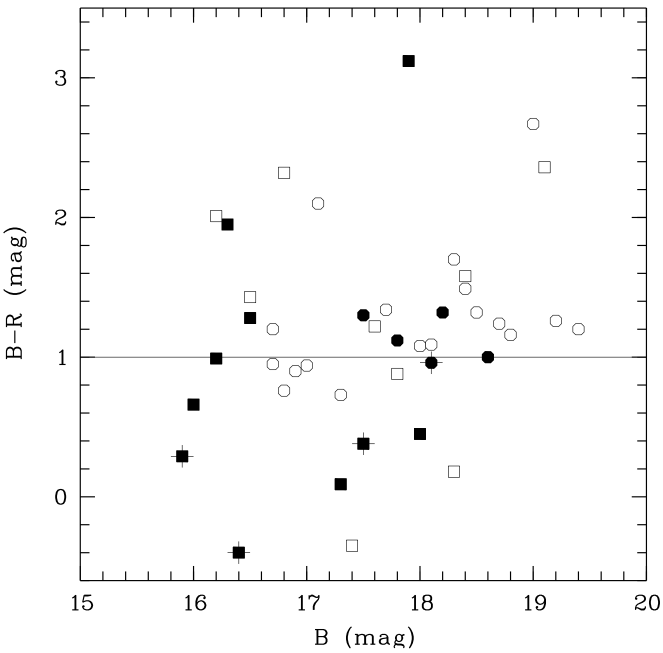

Fig. 1. Colour distribution for the random sample of 42 second priority candidates in the strip δ=35–40° (HS 1423+3945 is not included because its APM-colour is not available). The APM classification is shown by circles for stellar and squares for non-stellar images. The filled symbols show the emission-line objects identified by follow-up spectroscopy. BCG/HII-galaxies are marked by an additional cross. 4 of 5 APM stellar-type emission-line objects are either QSOs or distant luminous galaxies. The horizontal line at $(B-R)=1^{\rm m}_{\cdot}0$ shows the colour limit for the selection of BCG candidates among the second priority objects classified as non-stellar in the APM.

jects from the random subsample resulted in the following conclusions:

- The second priority candidates classified as BCG/HII based on their slit spectra all have rather blue colours according to the APM database (APM $(B-R) \leq 1\overset{m}{.}0$). In this colour range BCGs constitute about 33% of all second priority objects classified by APM as galaxies (Figure 1),
- Most of the ELGs of other types are redder than BCGs,
- One BCG of the four newly found is classified in the APM as stellar. Possibly at faint magnitudes some fraction of very compact BCGs are not distinguished by the APM from blue stars. Therefore also the APM information is of no help to discriminate the very compact faint BCGs from blue stars at the faint end of the second priority candidates.

Therefore, having in mind to develop a strategy to pick up as many as possible low-mass BCG/HII-galaxies in the HSS region, but accounting as well for a high enough detection rate, we created an subsample of second priority BCG candidates, which fulfill the following additional criteria:

- APM non-stellar classification, and
- a blue colour ($(B-R) < 1\overset{m}{.}0$) on the APM

Of 633 objects from the second priority list in the strip δ=35–40° 80 candidates were selected by these criteria. Eleven candidates from this additional list were observed by snap-shot spectroscopy. All of them have turned out to be ELGs of various types. 3 of them are certain BCGs, and 4 more are probable BCG/HII-galaxies. They are listed in Table 3 and are marked with ‡.

5. Discussion

5.1. The Fourth List

As shown in Table 1, among 104 observed emission-line objects 66 (63%) were classified based on the character of their spectra and their absolute magnitudes as HII/BCGs or probable BCGs. Since the main goal of the HSS is an efficient search for new BCGs, the fraction of this type among all confirmed ELGs of the first priority list (~68 %, or 63 % among all emission-line objects) is encouraging.

The distribution of new HSS ELGs in the line-ratio diagrams [OIII] λ 5007/Hβ versus [NII] λ 6583/Hα and [OIII] λ 5007/Hβ versus [OII] λ 3727/[OIII] λ 5007 (see Baldwin et al. (1981), Veilleux & Osterbrock (1987) for details) in general is similar to that shown in Paper I as may be expected since the selection criteria are identical. Several new BCGs with very strong emission lines located in the metal-poor regions of these diagrams were reobserved later with higher signal-to-noise ratio, and four of them (0951+3841, 1028+3843, 1124+3635 and 1309+3806) are found to have O/H < 1/10 $(O/H)_{\odot}$. A full description of the selection procedure for low-metallicity candidates based on snap-shot spectra is given in Kniazev et al. (2000).

The snap-shot spectroscopy of the random selected sample of second priority candidates detected only 4 additional BCG/HII galaxies (≈10%, cf. Table 1). We expect therefore, not much more than ≈60 BCGs among the 633 second priority candidates of the δ=35–40° strip.

To find these BCGs efficiently we used additional selection criteria based on the APM, which are fulfilled also by most of the BCGs from the first priority list. For this subsample of 80 candidates spectroscopic information is available for 24 objects: 11 were observed by us due to this selection, 10 were already observed as part of the random sample, and for 3 the information was taken from the literature. Altogether 10 BCGs or probable BCGs were found among them. The current estimate of detection rate for BCGs in the APM selected sample is therefore ≈40%.

5.2. Summary of the present status of the survey

Altogether among the objects of first priority in Papers I through IV, we discovered 321 new emission-line objects (20 of them QSOs), and for 55 known ELGs we got quantitative data for their emission lines. Preliminary classification of the 356 ELGs yields 275 (~77 %) confident or probable blue compact/low-mass HII-galaxies. This large fraction demonstrates the high efficiency of this survey to find low-mass galaxies with HII-type spectra on the Hamburg Quasar Survey photoplates. A statistical analysis of this BCG sample, supplemented with galaxies from the SBS, the Case, and the Heidelberg Void samples, is underway. Fourteen more BCGs were found among the second priority candidates.

6. Conclusions

We conducted follow-up spectroscopy of candidates from the Hamburg/SAO Survey for ELGs. Summarizing the results presented, the analysis of the content of various types of objects, and the discussion above, we draw the following conclusions:

- The applied methods to detect ELG candidates on the plates of the Hamburg Quasar Survey give a reasonably high detection rate of emission-line objects: ~ 77% in the average, among the first priority candidates as defined in Papers I to IV.
- The high fraction of BCG/HII galaxies among all newly discovered ELGs (about 68 % in this paper) is in line with our main goal — to pick up efficiently a deep BCG sample in the sky region under analysis.
- Besides of ELGs we found also 8 new quasars, all with Lyα in the wavelength region 4950 − 5100 Å (i.e with $3.15 < z < 3.30$) near the red boundary of the IIIa-J objective prism photoplates. These objects are a

byproduct of the survey, as their Lyα line is mistaken for the [OIII] λ 5007 Å line.
- The snap-shot spectroscopy of the random selected sample of second priority candidates shows that BCG/HII-galaxies represent only a small part of the second priority sample ($\approx$10%). Applying additional selection criteria based on APM classification and $(B - R)$ colour allows to extract more reliably these BCGs, except for very compact ones.

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References

Afanasiev V.L., Burenkov A.N., Vlasyuk V.V., Drabek S.V. 1995, SAO RAS internal report No. 247
Augarde R., Chalabaev A., Comte G., Hunth D., Maehara H., 1994, A&AS 104, 259
Baldwin J.A., Phillips M.M., Terlevich R., 1981, PASP 93, 5
Bohlin R.C., 1996, AJ 111, 1743
Engels D., Cordis L., Köhler T. 1994, Proc. IAU Symp. 161, eds. H.T. MacGillivray, Kluwer, Dordrecht, 317
de Grijp M.H.K., Keel W.C.,Miley G.K., Goudfrooij P., Lub J., 1992, A&AS 96, 389
Hagen H.-J., Groote D., Engels, D., Reimers D., 1995, A&AS 111, 195
Hagen H.-J, Engels D., Reimers D., 1999, A&AS 134, 483
Hopp U., Engels D., R.Green, Ugryumov A.V., Izotov Y.I., Hagen H.-J., Kniazev A.Y., Lipovetsky V.A., Pustilnik S.A., Brosch N., Martin J.-M., Masegosa J., Márquez I., 2000, A&AS 142, 417 (Paper III)
Huchra J.P., Geller M.J., Corwin H.G.Jr., 1995, ApJS 99, 391
Huchtmeier W., Richter O., A General Catalog of HI Observations of Galaxies, 1989, New York, Springer-Verlag
Irwin M., 1998, http://www.ast.cam.ac.uk/~apmcat/
Izotov Y.I., Guseva N.G., Lipovetsky V.A., Neizvestny S.I., Stepanian J.A., Kniazev A.Y., 1993a, Astronomy & Astrophysics Transactions 3, 179
Izotov Yu.I., Lipovetsky V.A., Guseva N.G. 1993b, in: "The Feedback of Chemical Evolution on the Stellar Content of Galaxies", eds. D.Alloin & G.Stasinska, p.127
Kniazev A.Y., Pustilnik S.A., Ugryumov A.V., Kniazeva T.F., 2000, Astronomy Letters 26, issue 2, 129
Markarian B.E., Lipovetsky V.A., Stepanian J.A., 1983, Afz 19, 29
Oke J.B., 1990, AJ 99, 1621
Pesch P., Stephenson C.B., MacConnell D.J., 1995, ApJS 98, 41
Popescu C.C., Hopp U., Hagen H.-J., Elsässer H., 1996, A&AS 116, 43
Popescu C.C., Hopp U., 2000, A&AS 142, 247
Pustilnik S.A., Ugryumov A.V., Lipovetsky V.A., Thuan T.X., Guseva N.G., 1995, ApJ 443, 499
Pustilnik S.A., Engels D., Ugryumov A.V., Lipovetsky V.A., Hagen H.-J., Kniazev A.Y., Izotov Y.I., Richter G., 1999, A&AS 135, 299 (Paper II)
Ramella M., Geller M.J., Huchra J.P., Thorstensen J.R., 1995, AJ 109, 1458
Salzer J.J., MacAlpine G.M., Boroson T.A., 1989, ApJS 70, 479
Salzer J.J., Moody J.W., Rosenberg J.L., Gregory S.A., Newberry M.V., 1995, AJ 109, 2376
Schneider D.P., Schmidt M., Gunn J.E., 1994, AJ 107, 1245
Stepanian J.A., 1994, Proc. IAU Symp. 161, Kluwer, Dordrecht, eds. H.T. MacGillivray, 731
Takase B., Miyauchi-Isobe N., 1993, PNAOJ 3, 169
Thuan T.X., Izotov Yu.I., Lipovetsky V.A., Pustilnik S.A., 1994, Proc. ESO/OHP Workshop "Dwarf Galaxies", eds. Meylan & Prugniel, p.421
Tift W.C., Kirshner R.P., Gregory S.A., Moody J.W., 1986, ApJ 310, 75
Ugryumov A.V., 1997, Ph.D. Thesis, SAO RAS.
Ugryumov A.V., Pustilnik S.A., Lipovetsky V.A., Izotov Yu.I., Richter G.M., 1998, A&AS 131, 295
Ugryumov A.V., Engels D., Lipovetsky V.A., Hagen H.-J., Hopp U., Richter G.M., Pustilnik S.A., Kniazev A.Y., Izotov Y.I., Popescu C.C., 1999, A&AS 135, 511 (Paper I)
Veilleux S., Osterbrock D.E., 1987, ApJS 63, 295
Vennik J., Hopp U., Popescu C.C., 2000, A&AS 142, 399
Weistrop D., Downes R.A., 1991, AJ 102, 1680

Table 3. Coordinates, Velocities and Magnitudes of Emission–Line Galaxies

#	Name	α (1950)	δ (1950)	$V^a_{hel} \pm \sigma_V$	m_B	$M_B{}^b$	Type	Other names from NED and number of reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	HS 0732+3529	07 32 23.3	+35 29 07	3730 ± 42	17.80	–15.68	BCG	
2	HS 0758+3901	07 58 58.2	+39 01 29	11621 ± 57	19.20	–16.75	BCG	
3	HS 0759+3811	07 59 17.0	+38 11 51	6142 ± 54	17.80	–16.77	BCG	
4	HS 0801+3740	08 01 51.5	+37 40 21	9823 ± 54	18.70	–16.89	BCG	
5	HS 0801+3746†	08 01 47.5	+37 46 06	10793 ± 100	16.20	–19.59	NON	
6	HS 0803+3648	08 03 29.2	+36 48 38	9698 ± 66	18.40	–17.16	BCG	
7	HS 0826+3521	08 26 52.2	+35 21 17	18910 ± 200	19.20	–17.81	NON	
8	HS 0834+3741	08 34 11.6	+37 41 14	12509 ± 15	18.30	–17.81	BCG?	
9	HS 0837+3816	08 37 53.4	+38 16 08	12269 ± 3	17.80	–18.27	SBN?	
10	HS 0840+3938	08 40 18.5	+39 38 21	9646 ± 102	17.40	–18.15	BCG?	
11	HS 0840+4013	08 40 42.4	+40 13 23	8887 ± 15	17.40	–17.97	DANS?	KUG 0840+402
12	HS 0841+3959	08 41 31.0	+39 59 15	34316 ± 90	+18.10	–20.20	SBN	
13	HS 0843+3637	08 43 23.6	+36 37 23	3207 ± 51	15.40	–17.76	BCG	Mkn 627,CG 224, **1**
14	HS 0847+3639	08 47 29.5	+36 39 17	7659 ± 108	18.10	–16.95	SBN?	KUG 0847+366, **7**
15	HS 0852+3614	08 52 00.8	+36 14 54	8123 ± 72	19.20	–15.97	BCG?	
16	HS 0852+4003	08 52 53.2	+40 03 41	1941 ± 20	16.50	–15.56	BCG	KUG 0852+400A
17	HS 0900+3651	09 00 55.0	+36 51 10	17303 ± 48	18.40	–18.42	BCG	
18	HS 0902+3759	09 02 37.5	+37 59 39	14331 ± 60	19.30	–17.11	SBN	IRAS 09026+3759
19	HS 0902+4005	09 02 58.3	+40 05 38	14453 ± 27	17.80	–18.62	BCG	
20	HS 0903+4349	09 03 31.9	+43 49 45	7611 ± 100	20.20	–14.83	BCG	
21	HS 0904+4357	09 04 12.7	+43 57 31	14814 ± 74	18.70	–17.78	DANS?	
22	HS 0904+4400	09 04 10.1	+44 00 56	17316 ± 55	17.40	–19.42	BCG?	
23	HS 0905+3948	09 05 45.2	+39 48 24	12850 ± 21	18.60	–17.57	BCG	
24	HS 0907+3728	09 07 02.4	+37 28 08	9045 ± 30	16.40	–19.01	SBN	
25	HS 0913+3516	09 13 59.1	+35 16 48	17098 ± 63	19.50	–17.29	BCG	
26	HS 0925+3529	09 25 41.4	+35 29 47	4556 ± 15	19.20	–14.72	BCG	
27	HS 0928+3725†	09 28 24.7	+37 25 25	14788 ± 39	18.00	–18.47	SBN?	
28	HS 0928+4006	09 28 35.6	+40 06 57	4295 ± 33	18.90	–14.89	BCG	
29	HS 0930+3548	09 30 08.3	+35 48 41	6871 ± 30	18.50	–16.31	BCG	
30	HS 0934+3629†	09 34 00.3	+36 29 07	53840 ± 66	17.50	–21.78	Sy1?	IRAS F09339+3629
31	HS 0936+3601†	09 36 03.9	+36 01 40	6011 ± 37	17.30	–17.22	DANS?	
32	HS 0936+3648†	09 36 19.7	+36 48 04	6018 ± 39	16.00	–18.52	SBN?	CG270, **4**
33	HS 0938+3544†	09 38 45.7	+35 44 18	56334 ± 61	18.60	–20.78	Sy1?	
34	HS 0942+3600	09 42 09.4	+36 00 30	6668 ± 51	16.20	–18.54	BCG	CG 278, **10**
35	HS 0942+3644	09 42 41.2	+36 44 58	9856 ± 36	15.80	–19.79	SBN	CG 283
36	HS 0947+3559	09 47 33.7	+35 59 55	5960 ± 54	16.30	–18.20	SBN	CG295, KUG 0947+359, **1**
37	HS 0951+3606	09 51 24.7	+36 06 29	12023 ± 59	17.50	–18.52	SBN?	
38	HS 0951+3841	09 51 46.4	+38 41 13	5172 ± 10	16.80	–17.39	BCG	
39	HS 0952+3803	09 52 39.9	+38 03 27	9535 ± 106	18.20	–17.32	DANS?	

Table 3. (Continued)

#	Name	α (1950)	δ (1950)	$V_{hel}^{a} \pm \sigma_V$	m_B	M_B^{b}	Type	Other names from NED and number of reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
40	HS 0958+4043	09 58 23.4	+40 43 45	13493 ± 56	19.50	–16.78	BCG	
41	HS 1014+4030	10 14 26.2	+40 30 00	19986 ± 46	17.40	–19.73	BCG	
42	HS 1014+4916	10 14 01.9	+49 16 47	15904 ± 29	18.00	–18.63	SBN?	
43	HS 1018+3847	10 18 49.6	+38 47 58	4204 ± 24	16.50	–17.24	BCG	
44	HS 1021+3637†	10 21 57.3	+36 37 06	52551 ± 108	18.20	–21.03	SBN?	
45	HS 1021+4218	10 21 12.8	+42 18 36	11000 ± 20	18.00	–17.83	BCG	
46	HS 1025+4005†	10 25 51.8	+40 05 04	9040 ± 45	15.90	–19.51	BCG	KUG 1025+400D
47	HS 1026+3521	10 26 25.7	+35 21 02	11129 ± 30	18.20	–17.66	BCG	
48	HS 1028+3843	10 28 57.7	+38 43 34	9014 ± 21	19.40	–16.00	BCG	
49	HS 1047+3714†	10 47 13.6	+37 14 23	10461 ± 45	16.30	–19.42	LINER?	
50	HS 1048+4026	10 48 00.8	+40 26 08	38840 ± 51	18.90	–19.67	SBN?	
51	HS 1050+4002	10 50 40.4	+40 02 35	8451 ± 45	17.90	–17.36	BCG	
52	HS 1059+3934	10 59 22.0	+39 34 54	3274 ± 66	18.20	–15.00	BCG	
53	HS 1102+3644	11 02 05.1	+36 44 50	22012 ± 204	17.00	–20.34	LINER?	
54	HS 1107+3524	11 07 53.1	+35 24 36	9492 ± 18	17.40	–18.11	BCG	**3**
55	HS 1107+3637	11 07 04.0	+36 37 16	8088 ± 15	19.50	–15.66	BCG	**3**
56	HS 1107+3831	11 07 09.7	+38 31 14	9543 ± 33	+14.34	–21.18	BCG	CG1388, KUG 1107+385
57	HS 1116+3951	11 16 33.9	+39 51 58	10090 ± 131	+16.93	–18.71	SBN	
58	HS 1118+3842	11 18 46.8	+38 42 06	10433 ± 75	+18.52	–17.20	BCG	
59	HS 1124+3635	11 24 49.4	+36 35 59	9160 ± 21	+17.96	–17.43	BCG	
60	HS 1125+3624	11 25 43.9	+36 24 23	10488 ± 39	+18.31	–17.42	BCG	
61	HS 1125+3748	11 25 22.4	+37 48 35	10689 ± 18	+16.50	–19.27	BCG	CSO 343
62	HS 1126+3701	11 26 33.8	+37 01 27	12808 ± 50	+16.02	–20.16	BCG	
63	HS 1129+3730	11 29 11.2	+37 30 14	12787 ± 33	+17.71	–18.45	BCG	
64	HS 1134+3639	11 34 15.7	+36 39 52	1595 ± 36	17.10	–14.54	BCG	NPM1G +36.0258
65	HS 1134+3640	11 34 00.5	+36 40 19	1462 ± 58			SA in Sp?	SA in NGC 3755
66	HS 1135+3709	11 35 38.0	+37 09 58	3251 ± 49	18.10	–15.08	DANS	
67	HS 1144+3552	11 44 37.6	+35 52 38	11001 ± 33	+17.16	–18.67	BCG	
68	HS 1145+3709	11 45 53.4	+37 09 55	12129 ± 39	16.60	–19.44	SBN	CSO 365, KUG 1145+371, **1**
69	HS 1147+3653	11 47 53.3	+36 53 14	9207 ± 43	+17.80	–17.65	DANS?	
70	HS 1150+3756	11 50 14.8	+37 56 04	11183 ± 90	+19.08	–16.79	BCG?	PC 1150+3756, **8**
71	HS 1159+3701	11 59 34.6	+37 01 29	6847 ± 67	17.40	–17.40	BCG	
72	HS 1221+3721	12 21 21.1	+37 21 56	3907 ± 27	17.90	–15.68	BCG	
73	HS 1228+3632	12 28 04.7	+36 32 12	10329 ± 54	+19.30	–16.40	BCG	
74	HS 1240+3902	12 40 52.9	+39 02 34	7030 ± 30	+17.02	–17.84	BCG	
75	HS 1300+3646	13 00 24.1	+36 46 31	9081 ± 48	+18.41	–17.01	BCG	NGP9 F269-0522706
76	HS 1301+3835	13 01 26.8	+38 35 02	8732 ± 45	17.40	–17.93	BCG?	
77	HS 1308+3545	13 08 43.3	+35 45 55	776 ± 54	18.10	–11.97	SA in Im	UGC 8261
78	HS 1309+3806	13 09 17.9	+38 06 54	16011 ± 36	+19.23	–17.42	BCG	NGP9 F269-0162165
79	HS 1318+3624	13 18 34.4	+36 24 48	7590 ± 45	18.00	–17.03	BCG	

Table 3. (Continued)

#	Name	α (1950)	δ (1950)	$V_{hel}^{a} \pm \sigma_V$	m_B	M_B^{b}	Type	Other names from NED and number of reference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
80	HS 1324+4019	13 24 05.3	+40 19 39	7671 ± 39	17.60	–17.45	BCG	
81	HS 1331+3657	13 31 46.5	+36 57 21	17949 ± 22	18.00	–18.90	BCG	**3**
82	HS 1344+3511	13 44 53.9	+35 11 21	16101 ± 57	16.80	–19.86	SBN	CG 1189, **2**
83	HS 1347+3553	13 47 12.2	+35 53 48	17062 ± 111	19.50	–17.28	DANS?	
84	HS 1347+3811	13 47 02.3	+38 11 35	2804 ± 36	18.80	–14.06	BCG	**3**, **6**
85	HS 1349+3942	13 49 22.9	+39 42 04	1752 ± 50	16.70	–15.14	BCG	**5**, **6**
86	HS 1350+3538†	13 50 13.8	+35 38 37	17791 ± 519	17.90	–18.98	SBN?	
87	HS 1400+3927	14 00 29.9	+39 27 38	1396 ± 39	17.20	–14.15	BCG	CG 330, **9**
88	HS 1408+3857	14 08 37.6	+38 57 11	7701 ± 37	16.80	–18.26	BCG	CG 369, **9**
89	HS 1425+3835‡	14 25 14.6	+38 35 33	6548 ± 21	16.80	–17.91	BCG?	CG 0435, **5**, **6**
90	HS 1435+3645‡	14 35 23.5	+36 45 12	15655 ± 48	+17.10	–19.50	BCG?	
91	HS 1440+3805	14 40 08.8	+38 05 06	9599 ± 27	16.70	–18.84	DANS?	NPM1G +38.0321, **5**, **6**
92	HS 1440+3828‡	14 40 40.0	+38 28 52	20761 ± 12	17.28	–19.93	SBN?	
93	HS 1450+3903‡	14 50 04.8	+39 03 11	18096 ± 42	+16.83	–20.08	SBN	
94	HS 1502+4152	15 02 31.3	+41 52 35	5004 ± 30	+16.35	–17.77	BCG	**5**, **6**
95	HS 1504+3922	15 04 15.6	+39 22 16	8962 ± 54	18.80	–16.59	BCG	CG 624, **9**
96	HS 1504+3923	15 04 10.9	+39 23 21	9189 ± 36	18.30	–17.14	BCG	CG 623
97	HS 1509+4409	15 09 56.8	+44 09 28	8284 ± 69			SBN?	
98	HS 1519+3948‡	15 19 49.0	+39 48 19	14716 ± 21	17.60	–18.86	BCG?	
99	HS 1520+3717	15 20 30.6	+37 17 56	11239 ± 63	+15.42	–20.46	BCG	**3**
100	HS 1521+3617‡	15 21 04.9	+36 17 24	6998 ± 24	+16.88	–17.97	BCG	
101	HS 1524+4205	15 24 08.0	+42 05 01	6700 ± 30	18.40	–16.36	DANS?	**5**
102	HS 1526+4045	15 26 56.7	+40 45 17	8610 ± 9	17.70	–17.60	DANS?	**5**
103	HS 1528+3858‡	15 28 43.3	+38 58 11	10579 ± 69	17.60	–18.15	DANS?	
104	HS 1543+3602	15 43 12.5	+36 02 46	1889 ± 18	16.00	–16.00	BCG	ABELL 2124
105	HS 1543+4525	15 43 23.3	+45 25 45	11519 ± 27	17.40	–18.53	DANS?	**5**, **6**
106	HS 1544+3803‡	15 44 21.6	+38 03 12	12008 ± 27	17.20	–18.82	BCG?	
107	HS 1546+3526	15 46 54.3	+35 26 24	16525 ± 27	18.20	–18.52	BCG	
108	HS 1546+4755	15 46 56.5	+47 55 34	11250 ± 9	18.90	–16.98	BCG	**5**, **6**
109	HS 1558+3543	15 58 27.3	+35 43 15	20284 ± 69	18.30	–18.87	BCG	**3**
110	HS 1608+3654	16 08 31.5	+36 54 42	9586 ± 12	17.30	–18.23	BCG	**3**
111	HS 1609+4827	16 09 44.4	+48 27 44	2817 ± 24	16.40	–16.47	BCG	**5**, **6**
112	HS 1612+3650	16 12 34.7	+36 50 06	8750 ± 24	18.60	–16.73	BCG	
113	HS 1612+3720‡	16 12 30.0	+37 20 35	11296 ± 12	17.50	–18.39	BCG	
114	HS 1617+3757	16 17 32.0	+37 57 55	9118 ± 15	18.20	–17.22	BCG	
115	HS 1619+3523	16 19 47.3	+35 23 16	15274 ± 66	16.80	–19.74	LINER?	KUG 1619+353B
116	HS 1619+3752	16 19 55.7	+37 52 35	9883 ± 9	17.30	–18.30	BCG	PC 1619+3752, **8**
117	HS 1620+4003†	16 20 49.9	+40 03 47	18903 ± 45	16.20	–20.81	LINER	
118	HS 1627+3927‡	16 27 27.4	+39 27 26	7984 ± 9	17.80	–17.34	BCG	ABELL 2199:[BO85]156
119	HS 1627+3945‡	16 27 04.8	+39 45 29	8122 ± 15	+15.11	–20.06	SBN?	ABELL 2199:[BO85]107

[a] Heliocentric velocities.; [b] Absolute magnitudes are not corrected for galactic extinction
+ APM magnitudes; † objects from the second priority random sample; ‡ galaxies from the APM selected sample
References: 1 – Augarde et al. (1994); **2** – de Grijp et al. (1992); **3** – Hopp et al. (2000); **4** – Huchra et al. (1995)
5 – Popescu et al. (1996); **6** – Popescu et al. (2000); **7** – Ramella et al. (1995); **8** – Schneider et al. (1994)
9 – Tift et al. (1986); **10** – Weistrop & Downes (1991)

Table 4. Emission line parameters

#	Name	F(Hβ)[a]	$\frac{F(\lambda3727)}{F(H\beta)}$	$\frac{F(\lambda5007)}{F(H\beta)}$	$\frac{F(H\alpha)}{F(H\beta)}$	$\frac{F(\lambda6583)}{F(H\alpha)}$	$\frac{F([SII])}{F(H\alpha)}$	$W_{\lambda3727}$(Å)	$W_{H\beta}$(Å)	$W_{\lambda5007}$(Å)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1	HS 0732+3529	45	2.53	10.09	5.89	0.03	–	66	21	237
2	HS 0758+3901	15	4.93	6.00	4.40	0.06	0.23	108	28	199
3	HS 0759+3811	37	2.22	2.86	3.38	0.06	0.15	31	18	56
4	HS 0801+3740	42	3.17	2.55	3.38	0.11	0.35	96	38	106
5	HS 0801+3746[†]	+47	–	–	–	–	–	–	+12	–
6	HS 0803+3648	33	3.21	3.52	3.64	0.09	0.23	65	29	111
7	HS 0826+3521	+56	–	–	–	–	0.50	–	+38	–
8	HS 0834+3741	36	2.78	2.33	1.14	–	–	85	60	127
9	HS 0837+3816	13	6.92	4.77	4.38	0.35	–	66	10	48
10	HS 0840+3938	42	4.45	3.17	3.43	0.07	0.36	67	16	53
11	HS 0840+4013	+61	–	–	–	0.49	–	67	+36	–
12	HS 0841+3959	7	8.29	1.57	7.29	0.37	–	122	6	10
13	HS 0843+3637	326	2.64	4.28	4.47	0.04	0.17	112	66	343
14	HS 0847+3639	87	4.36	1.64	3.92	0.11	0.22	56	14	23
15	HS 0852+3614	5	6.00	4.40	4.00	–	–	42	7	30
16	HS 0852+4003	81	2.86	4.94	3.77	–	0.16	52	23	118
17	HS 0900+3651	38	2.16	4.63	3.37	0.05	0.23	81	52	225
18	HS 0902+3759	12	5.58	2.00	12.42	0.42	0.54	41	6	11
19	HS 0902+4005	82	3.54	3.83	3.26	0.04	0.25	94	32	130
20	HS 0903+4349*	7:	–	6.00	–	–	–	–	28	196
21	HS 0904+4357*	5:	3.40	1.80	–	–	–	42	16	25
22	HS 0904+4400*	10:	1.50	2.40	–	–	–	43	32	67
23	HS 0905+3948	44	3.05	2.77	3.98	–	0.15	56	20	57
24	HS 0907+3728	111	1.53	0.52	5.26	0.38	0.25	24	14	7
25	HS 0913+3516	19	3.79	2.95	2.89	0.09	0.51	94	17	51
26	HS 0925+3529	44	2.30	4.55	3.39	0.01	0.18	59	24	115
27	HS 0928+3725[†]	64	3.94	1.63	3.41	0.17	0.34	68	20	33
28	HS 0928+4006	40	1.35	5.20	3.50	0.04	0.19	39	21	109
29	HS 0930+3548	25	4.32	3.40	4.04	0.09	0.10	51	10	36
30	HS 0934+3629[†]	88	–	0.74	4.77	0.18	–	–	33	25
31	HS 0936+3601[†]	5	–	2.80	4.80	–	–	–	7	18
32	HS 0936+3648[†]	47	3.32	0.89	3.49	0.24	0.30	28	9	8
33	HS 0938+3544[†]	+23	–	+0.78	–	–	–	–	+108	45
34	HS 0942+3600	26	2.50	2.73	4.62	0.13	0.39	98	23	72
35	HS 0942+3644	30	3.73	2.00	4.57	0.24	0.43	39	9	17
36	HS 0947+3559	30	2.50	1.50	4.47	0.18	0.31	43	15	21
37	HS 0951+3606	24	1.50	2.33	6.67	0.21	0.34	51	16	37
38	HS 0951+3841	42	3.76	3.19	4.55	0.08	0.28	122	34	115
39	HS 0952+3803	4	–	2.75	2.75	–	–	–	10	27
40	HS 0958+4043*	19:	2.05	5.95	–	–	–	105	73	283

Table 4. (Continued)

#	Name	F(Hβ)^a	$\frac{F(\lambda3727)}{F(H\beta)}$	$\frac{F(\lambda5007)}{F(H\beta)}$	$\frac{F(H\alpha)}{F(H\beta)}$	$\frac{F(\lambda6583)}{F(H\alpha)}$	$\frac{F([SII])}{F(H\alpha)}$	$W_{\lambda3727}$(Å)	$W_{H\beta}$(Å)	$W_{\lambda5007}$(Å)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
41	HS 1014+4030*	69:	2.52	3.25	–	–	–	102	39	139
42	HS 1014+4916*	10:	4.90	1.00	–	–	–	102	15	16
43	HS 1018+3847	21	4.10	4.38	6.24	0.11	0.27	24	5	21
44	HS 1021+3637†	+18	–	+0.67	–	–	–	–	+34	19
45	HS 1021+4218*	13:	2.46	3.92	–	–	–	51	91	211
46	HS 1025+4005†	72	3.07	3.22	4.04	0.09	0.25	54	19	61
47	HS 1026+3521	15	1.87	7.53	5.60	0.05	0.25	49	20	166
48	HS 1028+3843	135	0.44	7.03	2.99	0.00	–	70	404	2819
49	HS 1047+3714†	+38	–	+2.24	–	1.97	0.87	14	+6	15
50	HS 1048+4026	+46	–	+0.78	–	–	–	14	+43	33
51	HS 1050+4002	30	3.90	3.87	3.47	0.02	–	106	31	122
52	HS 1059+3934	25	2.12	5.52	3.68	–	–	101	56	335
53	HS 1102+3644	+31	–	–	–	0.58	–	–	+11	–
54	HS 1107+3524	20	4.55	3.90	4.35	0.07	0.23	75	12	47
55	HS 1107+3637	21	2.43	5.24	3.67	0.04	0.12	–	39	210
56	HS 1107+3831	63	3.60	3.71	4.73	0.14	0.26	42	12	50
57	HS 1116+3951	34	5.21	1.62	3.00:	0.26	0.35	107	24	44
58	HS 1118+3842	13	4.54	6.15	3.00	0.23	–	118	27	170
59	HS 1124+3635	102	1.15	6.17	3.10	–	0.09	98	111	810
60	HS 1125+3624	41	3.41	3.39	3.46	0.14	0.27	127	30	112
61	HS 1125+3748	17	5.88	5.29	4.94	0.07	0.23	77	10	56
62	HS 1126+3701	32	3.38	6.09	3.53	0.06	0.25	44	12	78
63	HS 1129+3730	40	3.05	3.85	3.70	–	–	77	35	137
64	HS 1134+3639	10	7.30	5.80	4.70	0.09	0.36	48	8	55
65	HS 1134+3640	103	2.15	4.22	2.82	0.03	0.14	97	146	689
66	HS 1135+3709	+7	–	+0.71	–	–	–	–	+19	9
67	HS 1144+3552	23	2.96	4.74	3.26	–	–	201	151	686
68	HS 1145+3709	32	3.69	2.06	4.63	0.24	0.40	56	14	30
69	HS 1147+3653	+18	–	+0.33	–	0.33	0.72	–	+37	10
70	HS 1150+3756	14	3.29	3.29	2.21	–	–	141	26	90
71	HS 1159+3701	16	3.19	3.38	4.25	0.12	0.25	58	19	61
72	HS 1221+3721	27	1.30	4.78	2.70	0.03	0.21	41	41	190
73	HS 1228+3632	34	2.41	2.65	2.50	0.15	0.35	163	47	123
74	HS 1240+3902	77	1.12	5.36	3.12	–	0.08	83	101	498
75	HS 1300+3646	13	1.85	6.31	4.69	0.05	–	70	37	300
76	HS 1301+3835	6	8.00	5.67	6.50	0.21	0.72	21	3	20
77	HS 1308+3545	8	–	4.38	4.25	–	–	–	200:	333:
78	HS 1309+3806	50	0.48	8.30	3.96	–	–	73	218	1417
79	HS 1318+3624	26	2.54	4.62	4.08	0.07	0.25	81	31	138
80	HS 1324+4019	21	3.14	4.57	4.19	0.09	0.31	106	24	114

Table 4. (Continued)

#	Name (1)	F(Hβ)[a] (2)	$\frac{F(\lambda3727)}{F(H\beta)}$ (3)	$\frac{F(\lambda5007)}{F(H\beta)}$ (4)	$\frac{F(H\alpha)}{F(H\beta)}$ (5)	$\frac{F(\lambda6583)}{F(H\alpha)}$ (6)	$\frac{F([SII])}{F(H\alpha)}$ (7)	$W_{\lambda3727}$(Å) (8)	$W_{H\beta}$(Å) (9)	$W_{\lambda5007}$(Å) (10)
81	HS 1331+3657*	87:	1.16	6.55	–	–	–	49	81	525
82	HS 1344+3511	126	2.06	2.81	5.56	0.24	0.20	111	65	184
83	HS 1347+3553	13	1.69	–	2.77	–	–	27	16	–
84	HS 1347+3811	10	1.30	4.70	4.60	0.04	0.17	27	22	108
85	HS 1349+3942	23	2.43	3.26	5.30	0.11	0.29	41	15	54
86	HS 1350+3538†	+19	–	+0.32	–	–	–	–	+15	6
87	HS 1400+3927	107	1.55	5.39	3.44	0.03	0.14	94	66	375
88	HS 1408+3857	53	3.15	3.91	3.64	0.05	0.15	57	19	76
89	HS 1425+3835‡	45	4.20	2.11	–	–	–	94	11	25
90	HS 1435+3645‡	9	–	3.11	4.33	0.13	0.41	–	11	26
91	HS 1440+3805	14	2.14	0.57	–	–	–	40	10	5
92	HS 1440+3828‡	+16	–	–	–	0.31	–	44	+53	–
93	HS 1450+3903‡	25	2.72	0.64	4.08	0.34	0.22	39	11	7
94	HS 1502+4152	22	2.09	3.55	–	–	–	50	34	109
95	HS 1504+3922	97	0.91	5.69	3.04	0.02	0.13	83	151	854
96	HS 1504+3923	68	1.29	5.96	3.41	–	–	65	66	402
97	HS 1509+4409	7	8.43	3.86	–	–	–	31	3	11
98	HS 1519+3948‡	6	12.50	5.67	3.67	0.27	–	114	12	53
99	HS 1520+3717	11	5.36	4.73	4.36	0.10	0.46	81	7	36
100	HS 1521+3617‡	18	2.39	4.67	3.39	0.07	–	61	16	81
101	HS 1524+4205	5	7.20	2.20	–	–	–	58	3	7
102	HS 1526+4045	4	8.00	3.00	–	–	–	23	2	6
103	HS 1528+3858‡	+14	–	+0.93	–	–	–	–	+58	35
104	HS 1543+3602	226	1.82	5.14	3.17	–	0.10	88	46	246
105	HS 1543+4525	32	3.78	1.22	3.69	0.25	0.39	54	14	17
106	HS 1544+3803‡	33	3.33	2.61	4.67	0.23	0.20	132	14	39
107	HS 1546+3526	33	2.30	4.15	3.18	0.06	0.27	110	46	194
108	HS 1546+4755	105	2.86	5.08	3.31	0.07	0.09	152	55	261
109	HS 1558+3543	40	2.92	3.80	3.00	0.06	0.12	234	58	228
110	HS 1608+3654	23	6.35	4.04	4.65	0.04	0.32	191	11	46
111	HS 1609+4827	70	2.79	3.33	4.31	0.09	0.27	34	13	44
112	HS 1612+3650	38	2.79	4.08	3.11	0.03	0.19	103	31	133
113	HS 1612+3720‡	17	6.41	3.94	5.24	0.12	0.28	86	10	41
114	HS 1617+3757	149	0.98	6.68	2.93	–	0.07	171	215	1320
115	HS 1619+3523	52	1.87	3.85	4.48	0.60	0.38	25	9	35
116	HS 1619+3752	55	2.36	2.93	3.69	0.10	0.29	47	27	76
117	HS 1620+4003†	70	1.94	5.90	7.06	0.56	0.46	22	10	60
118	HS 1627+3927‡	33	1.55	4.55	3.24	0.05	0.14	64	50	233
119	HS 1627+3945‡	15	2.73	3.00	8.07	0.21	0.37	24	5	14

[a] Flux in 10^{-16} ergs s^{-1} sm^{-2} $Å^{-1}$; * objects observed during non-photometric conditions
† objects from the second priority random sample; ‡ galaxies from the APM selected sample
+ Parameters for Hα emission line; : Parameters with less confident values

Table 5. Coordinates, Redshifts and Magnitudes of QSOs

#	Name (1)	α (1950) (2)	δ (1950) (3)	z^a (4)	m_B (5)	Detected **emission lines** (6)
1	HS 0833+3516	08 33 50.4	+35 16 18	3.304	19.00	Lyα 1216 Å, SiIV/OIV] 1400 Å, CIV 1549 Å
2	HS 0844+3842	08 44 01.4	+38 42 13	3.177	19.70	Lyα 1216 Å, SiIV/OIV] 1400 Å, CIV 1549 Å
3	HS 0855+3724	08 55 59.7	+37 24 42	3.207	19.60	Lyα 1216 Å, CIV 1549 Å
4	HS 0857+3601[†]	08 57 55.0	+36 01 15	3.153	17.80	Lyα 1216 Å, SiIV/OIV] 1400 Å, CIV 1549 Å
5	HS 0954+3549	09 54 36.8	+35 49 40	3.296	+19.20	Lyα 1216 Å, SiIV/OIV] 1400 Å, CIV 1549 Å
6	HS 1005+3638	10 05 44.2	+36 38 01	3.162	17.50	Lyα 1216 Å, SiIV/OIV] 1400 Å, CIV 1549 Å
7	HS 1143+3954	11 43 10.9	+39 54 26	3.189	19.40	Lyα 1216 Å, SiIV/OIV] 1400 Å, CIV 1549 Å
8	HS 1215+3821	12 15 13.1	+38 21 45	3.161	+20.70	Lyα 1216 Å, SiIV/OIV] 1400 Å, CIV 1549 Å

[a] Observed redshift; [+] APM magnitudes; [†] objects from the second priority random sample

Table 6. Galaxies without detected emission lines

#	Name (1)	α (1950) (2)	δ (1950) (3)	v_0^a (4)	m_B (5)	M_B^b (6)	Absorption lines (7)
1	HS 0812+3516[†]	08 12 23.1	+35 16 23	33466	18.40	–19.85	CaK, CaH, Hβ, NaD
2	HS 0843+3536	08 43 49.9	+35 36 24	15883	18.80	–17.83	CaK, CaH, Hβ, NaD, Hα
3	HS 0929+3956	09 29 11.9	+39 56 52	6031	+19.27	–15.26	CaK, CaH, G_{band}, NaD, Hα
4	HS 0936+3753	09 36 14.4	+37 53 25	46285:	18.00	–20.95	CaK, CaH, G_{band}, Hβ, MgIb, Hα

[a] Heliocentric velocities; [b] Absolute magnitudes are not corrected for galactic extinction
[†] objects from the second priority random sample; [+] APM magnitude; : less confident values

Table 7. Stars

#	Name (1)	α (1950) (2)	δ (1950) (3)	m_B (4)	Type (5)	Spectral features (6)
1	HS 0737+3902	07 37 24.4	+39 02 30	17.40	G	CaK, CaH, G_{band}, MgIb, CaFe5269, H_α
2	HS 0745+3600	07 45 35.6	+36 00 22	18.80	A-F	H_β, H_α
3	HS 0750+3637	07 50 51.5	+36 37 07	18.30	G	CaK, CaH, G_{band}, MgIb, NaD, H_α
4	HS 0753+3519[†]	07 53 09.6	+35 19 59	16.70	F	CaK, CaH, H_δ, H_γ, H_β, CaFe5269, H_α
5	HS 0802+3809	08 02 01.0	+38 09 06	18.30	A-F	H_β, H_α
6	HS 0840+3615	08 40 50.4	+36 15 09	17.10	F	CaK, CaH, H_β, H_α
7	HS 0859+3519[†]	08 59 35.5	+35 19 21	19.00	M	
8	HS 0906+3846[†]	09 06 55.1	+38 46 29	18.50	G	CaK, CaH, G_{band}, H_β, MgIb, CaFe5269
9	HS 0929+3657[†]	09 29 38.9	+36 57 18	19.40	F-G	CaK, CaH, H_β, MgIb, CaFe5269, H_α
10	HS 0940+3753[†]	09 40 19.1	+37 53 33	17.10	F	H_β, MgIb, H_α
11	HS 0941+3659[†]	09 41 52.0	+36 59 20	16.50	F	CaK, CaH, G_{band}, H_β, MgIb, H_α
12	HS 1031+3524[†]	10 31 37.2	+35 24 12	17.00	A	H_γ, H_β, H_α
13	HS 1132+3904	11 32 17.3	+39 04 43	+17.84	A	H_γ, H_β, H_α
14	HS 1245+3842[†]	12 45 45.7	+38 42 19	16.80	F	CaK, CaH, H_β, MgIb, NaD, H_α
15	HS 1300+3748[†]	13 00 56.6	+37 48 16	16.90	F	H_γ, H_β, MgIb, H_α
16	HS 1408+3957	14 08 35.3	+39 57 29	18.70	F?	H_β, MgIb, H_α

[†] objects from the second priority random sample; [+] APM magnitude

Table 8. Spectroscopic classification for objects from the “random selected” sample observed with the Calar Alto 2.2m telescope

#	Name (1)	m_B (2)	Type (3)
1	HS 1007+3948	17.40	NOEM
2	HS 1013+3804	17.70	Star
3	HS 1029+4020	16.70	Star
4	HS 1322+3708	16.40	BCG?
5	HS 1355+3911	19.20	Star
6	HS 1408+3524	16.80	ABS
7	HS 1417+3921	18.30	NOEM
8	HS 1420+3726	17.50	BCG?
9	HS 1423+3945	18.50	SA in Sp
10	HS 1459+3608	18.80	NOEM
11	HS 1537+3520	17.60	NOEM
12	HS 1545+3531	18.00	NOEM
13	HS 1547+4008	17.30	NOEM
14	HS 1601+3859	18.40	NOEM
15	HS 1616+3627	16.50	Sy1
16	HS 1649+3621	18.10	BCG?
17	HS 1720+3929	17.80	NOEM